

## Path Analysis: Application of Health Belief Model and Social Cognitive Theory in Smoking Cessation in Surakarta

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### ABSTRACT

**Background:** Smoking is harmful to health. The percentage of smoking in Surakarta City is 23.11%. This study aims to analyze the theory of social cognitive and health belief models in smoking cessation behavior in Surakarta, Central Java.

**Subjects and Method:** It was a cross-sectional study conducted in Surakarta City from September to November 2023. A total of 200 adults aged  $\geq 15$  years were selected using snowballing sampling in the study. The dependent variable was smoking cessation behavior. The independent variables were perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived cues to action, self-efficacy, observational learning, reinforcement, expectations, expectancy, and behavioral capabilities.

**Results:** Self-efficacy had a direct effect on smoking cessation behavior ( $b = 3.30$ ;  $CI\ 95\% = 2.54$  to  $4.06$ ;  $p < 0.001$ ). Perceived benefits, perceived barriers, cues to action, perceived severity, perceived susceptibility, and observational learning had indirect effects on smoking cessation behavior.

**Conclusion:** Self-efficacy has a direct effect on smoking cessation behavior. Perceived benefits, perceived barriers, cues to action, perceived severity, perceived susceptibility, and observational learning have indirect effects on smoking cessation behavior.

**Keywords:** path analysis, health belief model, social cognitive theory, smoking behavior.

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### BACKGROUND

Smoking is a harmful behavior to health. Smoking can lead to numerous diseases. Salander et al. (2007) states that 80% of lung cancers are generated by smoking behavior. Not only for active smokers, passive smokers also have a risk of disease generated by cigarette smoke. Vanker et al. (2017)

states that maternal smoking and second-hand smoke in the environment are associated with mild and severe respiratory infections and asthma in children. Exposure to secondhand smoke can also reduce lung function in early life, and may increase the risk of lifelong decline in lung health.

According to Ministry of Health in 2019 at the 2018 National Riskesdas the percentage of smoking rates in Indonesia for people aged  $\geq 10$  years is 28.9% and in Central Java province the percentage of smokers is 28% (Kemenkes 2019a). Surakarta City is the city with the bottom 5 percent of smoking among cities in Central Java Province. Surakarta City is ranked 32 out of 35 cities with the highest smoking percentage in Central Java province. The percentage of smoking rate in Surakarta city is 23.11% and the percentage of non-smoking is 76.89% with a total of 1,167 people (Kemenkes, 2019b).

One form of disease and smoking behavior preventions in adolescents is by applying health behavior theory. Health Belief Model is one of the health behavior models that can be used to take steps to treat diseases and stop smoking behavior. The Health Belief Model is an intrapersonal theory encompassing knowledge and beliefs used in health promotion to design intervention and prevention programs (Burke, 2013). Anggreani et al. (2022) state in a meta-analysis study that the application of the health belief model can be used as a way to prevent smoking although it is not significantly.

Social cognitive theory is one of the health behavior models that can also be used to take steps to stop smoking. According to LaMorte (2022) Social Cognitive Theory is a behavioral theory that explains that learning occurs in a social context with dynamic and reciprocal interactions between people, the environment, and behavior. According to Martin et. al (2020) Social cognitive theory can be represented as a dynamic system which in turn can be used for the purpose of system identification and study design. A study conducted by Lin et. al (2023) states that constructs of Social cognitive theory influence smoking beha-

avior. A study conducted by Attarabeen et. al (2020) states that social cognitive theory has an influence in promoting smoking cessation efforts.

Based on the background elaboration above, researchers were interested in conducting a pathway analysis on the application of social cognitive theory and health belief model in smoking cessation behavior in Surakarta City.

## SUBJECTS AND METHOD

### 1. Study Design

The study population was adults aged  $>15$  years and the study sample was 200 adults  $>15$  years selected using snowballing sampling techniques.

### 2. Population and Sample

The study design used in this study was analytical observational with a cross-sectional approach. The study was conducted in Surakarta City from September to November 2023.

### 3. Study Variables

The dependent variable in this study was smoking cessation behavior and the independent variables were perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, self-efficacy, and observational learning.

### 4. Operational Definition of Variables

**Smoking cessation behavior** is an activity to stop consuming cigarettes.

**Perceived susceptibility** is the state of a person who perceives belief that he can be exposed to a disease.

**Perceived severity** is something that a person perceives in predicting the severity when suffering from a disease.

**Perceived benefits** are a person's activity in considering the benefits obtained between the costs required and the level of disease.

**Perceived barriers** are an obstacle that exists in a person when a person is in a healthy behavior.

**Cues to action** are the events, people, or things that drives a person to change a behavior.

**Self-efficacy** is a belief in one's own ability to do something.

**Observational learning** is the activity of witnessing and observing the behavior performed by others and then reproducing the action.

**5. Data analysis**

The study used univariate analysis, bivariate analysis, and pathway analysis. Data analysis was conducted using the STATA 17 application.

**6. Step of Path-Analysis**

- a. The model specification described the correlation between the variables to be studied.
- b. Model identification was carried out on the number of measured variables, the number of exogenous variables, endogenous variables, and variables to be estimated. At this stage, the degree of freedom (df) calculation was carried out to show whether path analysis can be performed.
- c. The suitability of the model based on tests and checks with the saturation model was Chi squared  $p \geq 0.05$ , GFI, NFI, CFI values was respectively  $\geq 0.90$ , RMSEA was  $< 0.05$

d. Parameter estimation is a causal correlation of variables indicated by regression coefficients both standardized and non-standardized.

e. Model re-specification is the final step of the path analysis stage.

**RESULTS**

**1. Sample Characteristics**

Table 1 showed the characteristics of 200 samples. In this study, the characteristics of the sample were taken based on smoking status, age, sub-district of residence, last education, and monthly income. The characteristics of the sample showed that 111 people or 55.5% of the sample had smoking cessation behavior and 89 people or 44.5% had smoking behavior. Based on age characteristics, 110 people or 55% of the sample had an age of 15-29 years and 90 people or 45% had an age of  $\geq 30$  years. Based on the sub-districts of residence 75 people or 37.5% live in Jebres Sub-District, 75 people or 37.5% live in Banjarsari Sub-District, and 50 people or 25% live in Laweyan Sub-District. Based on the characteristics of last education, 91 people or 45.5% had high school education (SMA) and 71 people or 35.5% had university education. Based on employment status, 152 people or 76% were employed, and based on monthly income, 105 people or 52.5% had monthly income below Rp 2,000,000.

**Table 1. Sample characteristics (categorical data).**

Variables	Category	Frequency (n)	Percentage (%)
<b>Smoking Status</b>	Smoking	89	44.5
	Cease Smoking	111	55.5
<b>Age</b>	15-29 Years	110	55
	$\geq 30$ Years	90	45
<b>Residence</b>	Jebres	75	37.5
	Banjarsari	75	37.5
	Laweyan	50	25
<b>Last Education</b>	Non-educated	2	1
	Priary School	0	0
	Secondary School	36	18

Variables	Category	Frequency (n)	Percentage (%)
<b>Employment Status</b>	High School	91	45.5
	University	71	35.5
	Employed	152	76
	Unemployed	48	24
<b>Monthly Income</b>	< Rp 2,000,000	105	52.5
	≥ Rp 2,000,000	95	47.5

## 2. Univariate analysis

Univariate analysis discovered that 90 people or 45% had low observational learning scores. In the expectation construct, 94 people or 47% have low expectations. A total of 84 people (42%) had low expectation scores. A total of 98 people (49%) had low behavioral capability scores. A total of 95 people (47.5%) had low perceived sus-

ceptibility scores. A total of 95 people (47.5%) had a low perceived severity. A total of 91 people (45.5%) had low a benefits value. A total of 123 people (61.5%) had a high perceived barrier. A total of 67 people (33.5%) had a low cue to action score. A total of 89 people (44.5%) had a low self-efficacy score.

**Table 2. Univariate Analysis of Social Cognitive Theory and Health Belief Model on Smoking Cessation (n= 200)**

Independent Variables	Category	Frequency (n)	Percentage (%)
<b>Observational Learning</b>	Low	90	45
	High	110	55
<b>Perceived Susceptibility</b>	Low	95	47.5
	High	105	52.5
<b>Perceived Severity</b>	Low	95	47.5
	High	105	52.5
<b>Perceived Benefits</b>	Low	91	45.5
	High	109	54.5
<b>Perceived Barriers</b>	Low	77	38.5
	High	123	61.5
<b>Cues to Action</b>	Low	67	33.5
	High	133	66.5
<b>Self-Efficacy</b>	Low	89	44.5
	High	111	55.5

## 3. Bivariate Analysis

Bivariate analysis was conducted with a chi-square test and exposed the odds ratio and confidence interval values of 95% for each independent variable. The results of the bivariate analysis discovered that one with a high observational learning score was 10.40 times more likely to engage in smoking cessation behavior than one with a low

observational learning value (OR= 10.40; 95% CI=5.15 to 21.16;  $p < 0.001$ ).

An individual with high perceived susceptibility score was 12.67 times more likely to cease smoking than one with a low perceived susceptibility score (OR= 12.67; 95% CI= 6.15 to 26.42;  $p < 0.001$ ).

An individual with a high perceived severity score was 33.15 times more likely to cease smoking than one with a low per-

ceived severity score (OR=33.15; 95% CI= 14.15 to 79.59; p<0.001).

An individual with a high perceived benefit was 31.81 times more likely to cease smoking than one with a low perceived benefit score (OR=31.81; 95% CI=13.73 to 74.93; p<0.001).

An individual with a low perceived barrier was 0.096 times more likely to cease smoking than one with a high score of

perceived barrier. (OR=0.096; 95% CI = 0.04 to 0.21; p<0.001).

An individual with a high score of cues to action was 11.63 times more likely to cease smoking than one with a low score of cues to action (OR=11.63; 95% CI=5.40 to 25.81; p<0.001).

An individual with a high self-efficacy score was 27.38 times more likely to cease smoking than one with a low efficacy score (OR=27.38; 95%CI=12.11-62.80; p< 0.001).

**Table 3. Bivariate analysis of Social Cognitive Theory and Health Belief Model on Smoking Cessation**

Variables	Smoking Status				Total		OR	95% CI	p
	Smoking		Cease Smoking		n	%			
	n	%	n	%					
<b>Observational Learning</b>									
Low (score<4)	66	73.33	24	26.67	90	100	10.40	5.15-21.16	<0.001
High (score≥4)	23	20.91	87	79.09	110	100			
<b>Perceived Susceptibility</b>									
Low (score<5)	70	73.68	25	26.32	95	100	12.67	6.15-26.42	<0.001
High (score≥5)	19	18.10	86	81.90	105	100			
<b>Perceived Severity</b>									
Low (score<6)	77	81.05	18	18.95	95	100	33.15	14.15-79.59	<0.001
High (score≥6)	12	11.43	93	88.57	105	100			
<b>Perceived Benefits</b>									
Low (score<6)	75	82.42	16	17.58	91	100	31.81	13.73-74.93	<0.001
High (Score≥6)	14	12.84	95	87.16	109	100			
<b>Perceived Barriers</b>									
Low (score<2)	11	14.29	66	85.71	77	100	0.096	0.04-0.21	<0.001
High (score≥2)	78	63.41	45	36.59	123	100			
<b>Cues to Action</b>									
Low (score<2)	54	80.60	13	19.40	67	100	11.63	5.40-25.81	<0.001
High (score ≥2)	35	26.32	98	73.68	133	100			
<b>Self-efficacy</b>									
Low (score <4)	73	82.02	16	17.98	89	100	27.38	12.11-62.80	<0.001
High (score ≥4)	16	14.41	95	85.59	111	100			

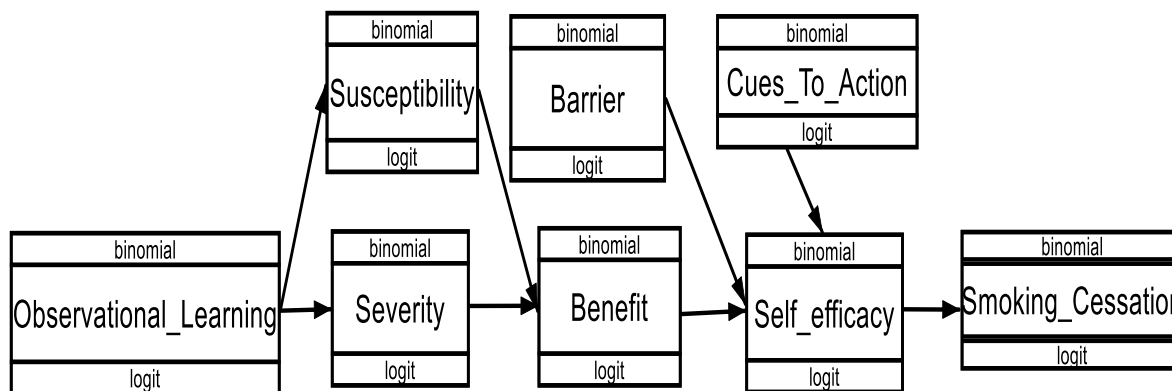
**4. Path analysis**

Figure 1 showed the association values of exogenous variables and endogenous vari-

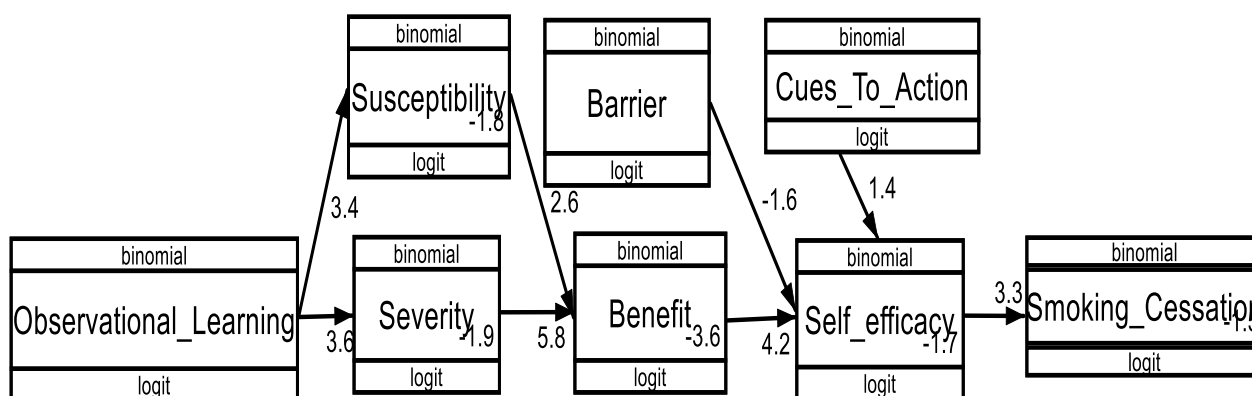
ables based on path coefficient values. Exogenous variables in this study were observational learning, perceived barriers, and

cues to action. Endogenous variables in this study were perceived susceptibility, perceived severity, perceived benefits, self-efficacy, and smoking cessation behavior. The

result of the degree of freedom (DF) calculation stated that the DF value in this pathway study was 25 or over identified so that pathway study can be carried out.



**Figure 1. Structural models of Social Cognitive Theory and Health Belief Model on smoking cessation**



**Figure 2. Structural models with estimation of Social Cognitive Theory and Health Belief Model on smoking cessation**

Figure 1 showed that smoking cessation behavior was directly affected by self-efficacy. Furthermore, indirectly, smoking cessation behavior was positively affected by cues to action, perceived benefits, perceived susceptibility, perceived severity, and observational learning. Smoking cessation behavior was negatively affected by the perceived barriers.

On the indirect effect of smoking cessation behavior, self-efficacy was affected by cues to action, perceived barriers, and

perceived benefits. The perceived benefit was affected by perceived susceptibility and perceived severity, and the perceived susceptibility and the perceived severity were affected by observational learning.

Figure 2 explains the estimation of the structural model of path analysis that has been carried out in this study. Model estimation in path analysis used the values of path coefficient, standard error, 95% CI, and p-values described in Table 4.

**Table 4. Path Analysis Results of Social Cognitive Theory and Health Belief Model on Smoking Cessation**

Dependent Variables	Independent Variables	b	SE	CI 95%		p
				Lower Limit	Upper Limit	
<b>Direct Effect</b>						
Smoking Cessation	← High self-efficacy	3.30	0.39	2.54	4.06	<0.001
<b>Indirect</b>						
High Self-Efficacy	← High perceived benefits	4.18	0.72	2.77	5.59	<0.001
	← High Cues to Action	1.37	0.77	-0.13	2.88	0.073
Low Self-Efficacy	← High perceived barriers	-1.56	0.75	-3.02	-0.97	0.037
High Perceived Benefit	← High perceived severity	5.76	0.87	4.06	7.47	<0.001
	← High perceived susceptibility	2.64	0.78	1.11	4.16	0.001
Perceived Severity	← Observational learning	3.57	0.41	2.77	4.37	<0.001
Perceived Susceptibility	← Observational learning	3.41	0.40	2.64	4.19	<0.001
AIC = 675.22						
BIC = 718.10						
Log Likelihood = -324.61						

Based on table 4, it was discovered that an individual with a high self-efficacy had higher logodds by 3.30 units to cease smoking than one with a low self-efficacy and it was statistically significant (b= 3.30; CI 95%= 2.54 to 4.06; p<0.001). An individual with a high score of perceived benefits had higher logodds by 4.18 units to have a high self-efficacy score than one with a low score of perceived benefits and it was statistically significant (b=4.18; 95% CI= 2.77 to 5.59; p<0.001).

An individual with a high score of cues to action had higher logodds by 1.37 units to have a high efficacy score than one with a low score of cues to act even though it was statistically insignificant (b = 1.37; 95% CI= -0.13 to 2.88; p=0.073). An individual with a high score of perceived barriers had lower logodds by 1.56 units to have a high self-efficacy than one with a low level of perceived benefits and it was statistically

significant (b= -1.56; CI 95%=-3.02 to -0.97; p=0.037).

An individual with a high score of perceived severity had higher logodds by 5.76 units to have a high perceived benefits than one with a low score of perceived severity and it was statistically significant (b= 5.76; 95% CI=4.06 to 7.47; p<0.001). An individual with a high score of perceived susceptibility had a higher logodds by 2.64 units to have a high perceived benefits than one with a low score of perceived susceptibility and it was statistically significant (b=2.64; 95% CI=1.11 to 4.16; p=0.001).

An individual with a high observational learning score had a higher logodds by 3.57 units to have high perceived severity than one with a low observational learning and it was statistically significant (b= 3.57; 95% CI=2.77 to 4.37; p<0.001). An individual with a high score of observational learning had higher logodds by 3.41 units to

have a high perceived susceptibility than one with a low observational learning score and it was statistically significant ( $b = 3.41$ ;  $SE = 0.40$ ;  $95\%CI = 2.64$  to  $4.19$ ;  $p < 0.001$ ).

## DISCUSSION

### **1. The effect of self-efficacy toward smoking cessation behavior.**

In this study, it was discovered that there was an effect of self-efficacy on smoking cessation behavior. This study is in line with a statement of Melizza et al. (2020) which states that an individual with a high self-efficacy will have a high intention to quit smoking. On the other hand, one with a low self-efficacy also has low motivation to cease smoking.

### **2. The effect of cues to action toward self-efficacy in smoking cessation behavior.**

This study discovered that there was an effect of self-efficacy on smoking cessation behavior. This study is in line with a statement of Tapera et al. (2020) which states that a teenager is less likely to smoke when having a conversation with parents about the dangers of smoking. It furtherly explains the importance of encouraging teenagers to reject anyone selling them cigarettes. This explains that cues to act from parents can increase adolescent self-efficacy to be able to commit non-smoking or cease smoking behaviors.

### **3. The effect of perceived barriers toward self-efficacy in smoking cessation behavior.**

In this study, it was discovered that there was an effect of perceived barriers toward self-efficacy. This study is in line with Georges et al. (2022) which states that a man has a perceived barrier to cease smoking because it is one form of chumminess with one another so that he feels insecure to quit smoking.

### **4. The effect of perceived benefits toward self-efficacy in smoking cessation behavior.**

This study discovered that there was an effect of perceived benefits on self-efficacy. This is in line with a statement of Carico et al. (2021) which states that perceived benefits is the benefits that individuals may obtain by carrying out smoking cessation behaviors. The perceived benefits is not just about avoiding adverse effects on health, an individual who understands the benefits and engages in smoking cessation behavior feels they can avoid the perceived threats if they engage in smoking behaviors such as lung cancer, and others.

### **5. The effect of perceived susceptibility toward perceived benefits in smoking cessation behavior.**

In this study, it was discovered that there was an effect of perceived susceptibility on perceived benefits in smoking cessation behavior. This study is in line with Fatian-Dastgerdi et al. (2022) which states that an individual who has a high perceived susceptibility will think that avoiding or taking preventive measures will provide benefits for that individual.

### **6. The effect of perceived severity toward perceived benefits in smoking cessation behavior.**

In this study, it was discovered that there was an effect of perceived severity toward perceived benefits. This study is in line with Irigoyen et al. (2020) which states that the perceived severity concerning a disease will make an individual seek information related to prevention. Furthermore, from the obtained information related to prevention, the individual feels a high perceived benefit within himself and in the end the high perceived benefits lead the individual engage in a prevention or cease a habit.



### **7. The effect of observational learning toward perceived severity concerning smoking cessation.**

In this study, it was discovered that there was an effect of observational learning toward perceived severity. This study is in line with Kaufman et al. (2019) which states that an individual can better understand the dangers of a disease or the dangers of a behavior if they learn from what is around them. Furthermore, it elaborates that observational learning is not based on what an individual experiences, it is from what they find around them instead.

### **8. The effect of observational learning toward perceived susceptibility in smoking cessation behavior.**

In this study, it was discovered that there was an effect of observational learning and perceived susceptibility. This study is in line with Kim (2021) who states that an event witnessed by an individual further improves the perceived susceptibility toward the negative effects of smoking on the individual than an event experienced by themselves.

#### **AUTHOR CONTRIBUTION**

Muhammad Fahrezi Al Ghifari was the main researcher on this study who determined the topic, conducts research, and collected data. Argyo Demartoto and Bhisma Murti were the main research assistants in the study.

#### **FUNDING AND SPONSORSHIP**

This study is self-funded.

#### **CONFLICT OF INTEREST**

There is no conflict of interest in this study.

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